

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SUMMARY OF CHANGES

Changes in Section 00800

NOTICE TO BIDDERS

Failure of the bidder to
Acknowledge receipt
Of this Amendment in
Item 19 of Standard
Form 1442 (Pg. 00010-2)
May result in REJECTION
Of the bid.

IFB NO. DACA51-02-B-0009

Amendment No. 3

Department of the Army, NYD
Corps of Engineers
New York, NY 10278-0090

AMENDMENT NO. 3 TO SPECIFICATIONS FOR REVITALIZE BARRACKS USMA PREPARATORY
SCHOOL BUILDINGS 1204 & 1205, FORT MONMOUTH, EATONTOWN, NEW JERSEY

TO BIDDERS

1. The following is made to the specifications and drawings.

SITE VISIT: The telephone numbers and fax number for the POC are: Barbara Folk
Corps of Engineers, Ft. Monmouth Resident Office, 732-389-3040, 732-532-6425, 732-389-1564 (fax).

SPECIFICATIONS

:Section 00800: Add paragraph 39.f as follows:

“f. The Contractor is required to recycle construction waste materials to the maximum possible extent.”

Section 09650

- a. In paragraph 1.1 delete ASTM D 2240 and ASTM F 1344 from the list of reference publications.
- b. Replace paragraph 2.2 with the following:

“2.2 SHEET VINYL FLOORING

Sheet vinyl flooring shall be composed of a homogeneous, vinyl composition. Flooring shall be not less than 72 inches wide. Sheet vinyl flooring without backing shall meet the overall thickness of 0.080 inches, composition, flexibility, indentation, and the solvent resistance requirements of ASTM F 1303, Type II. The solid vinyl color and pattern shall extend through the total thickness of the material. High quality vinyl welding rods for heat welding of joints shall be provided.”

- c. Delete paragraph 2.3 without substitution.
- d. Replace paragraph 3.5 with the following:

“3.5 INSTALLATION OF SHEET VINYL FLOORING

Sheet vinyl flooring shall be installed with adhesive in accordance with the manufacturer's written installation instructions. Flooring shall be fitted to the room by hand cutting, straight scribing, or pattern scribing as necessary to suit job conditions. Flooring shall be cut to, and fitted, around, all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Seams shall be cut by overlapping or under-scribing as recommended by the manufacturer. Seams and edges of sheet

vinyl flooring in room shall be bonded or welded as recommended by manufacturer. Flooring shall be installed with an integral cover base.

- e. Delete paragraph 3.6 without substitution.
- f. Add paragraph 2.9 ENTRANCE MATS

Entrance mats shall have extruded aluminum tread rails, with serrated aluminum inserts, connected by aluminum hinges and shall have a vinyl base cushion. Tread rails shall be mill finish 6063T aluminum alloy. Mats shall be surfaced applied frame. Tread rails shall run perpendicular to traffic flow.

- g. Drawing A-008 Add Note:

Room 217 – Woven wire storage lockers shall be full height up to underside of ribs

Section 13930A: Replace paragraph 1.2.1.2 with the following:

“1.2.1.2 The design of the system shall be based upon a water supply with a static pressure of 60 psi and a flow of 531 gpm at a residual pressure of 24 psi at hydrant 182 along Abbey Road. For underground water piping outside the building, a “c” value of 35 shall be used for existing CI pipe and a “c” value of 100 shall be used for new piping. A domestic flow of 400 gpm shall be considered to be flowing prior to the start of fire flow. A 450 gpm sprinkler flow shall be considered to occur next and a 500 gpm hose/ standpipe demand shall be considered to occur next.

Inside the building, hydraulic calculations shall be based upon the Hazen-Williams formula with a “c” value of 120 for steel piping and 140 for new cement lined ductile iron piping. Hydraulic calculations shall be based on operation of the fire pump provided in Section 13920A FIRE PUMPS.”

Section 16264A: Delete all references to diesel generator, and shall be corrected to refer to natural gas generators. All new installations shall be natural gas.

Section 16711: This section is revised and included in this amendment.

ENGINEERING AND CONSTRUCTION TECHNICAL STANDARD NO. 3

Attached for bidders guidance is a copy of the technical standard from Fort Monmouth on emergency generations/standby power systems. If conflicts arise between Section 16264A and this Supplement, contractor shall follow the more stringent requirement.

SKETCHES

- a. Replace electrical schematic for dryer operation with revised sketch.
- b. Included in this amendment is a sketch for pipe penetration detail.

DRAWINGS

Drawings M-101, M-102 and M-103 are added to the set of drawings in this amendment.

Delete reference to M001, M220, M221, M520, M521, MD13. These drawings are not part of this solicitation.

Drawing M-305: Delete the Glycol Make-Up One Shot Feeder Detail.

Drawing FP-1: Delete Note #3 and replace with "For flow and pressure see revised paragraph 1.2.1.2 in specification Section 13930A."

Drawing MP-18: Delete Note #4 and replace with "Water supply entering the building is 240 gallons per minute and at 22 psi."

Drawing C-4 is revised and included as part of this amendment.

Drawings A-001, A-008, A-009, A-011, A-016, A-017, A-018, A-023, A-024, A-025, A-030, A-030A, A-034, A-035, A-041, A-042, A-043, A-049, A-050, A-051, A-054, A-055, A-056, A-058, A-059 and A-066 (new) are included in this amendment.

Drawings i-001, i-002, i-003, i-004, i-007, i-008, i-009, i-011, i-012, i-013, i-014, i-022, i-023, i-024, i-025, i-026, i-027, i-028, i-031, i-032 and i-033 are revised and included in this amendment.

2. This Amendment shall be attached to the specifications and shall become a part thereof.

Attached

ELLA D. SNELL
C, Contracting Division
Contracting Officer

SECTION 16711
TELECOMMUNICATIONS OUTSIDE PLANT INFRASTRUCTURE SPECIFICATIONS

1.0 GENERAL

1.1. DESCRIPTION

- A. U.S.Army Communications and Electronics Command (CECOM) general conditions for contracts, referred to herein as the general conditions, together with the following campus telecommunications cabling specifications, which amend, modify and supplement various articles and provisions of the general conditions, are made part of the Contract and shall apply to all work under the Contract.
- B. The Contractor shall comply with all applicable CECOM standards and with all Federal, State, County, City, and other applicable codes, ordinances and regulations.
- C. Local electrical and building codes may differ from national codes. Where there are instances of ambiguity, refer to the Fort Monmouth COR for interpretation.
- D. This telecommunication specification is not intended as a complete material list of items required by the Contract. The contractor must provide all tools and materials necessary to complete the project.
- E. It is the intent of these specifications to provide a complete workable telecommunications pathway system ready for the Owner's use. Any item not specifically shown on the drawings or called for in the specifications, but normally required to carry out the work, is to be considered part of the Contract.
- F. Any given item of equipment or material shall be the product of one manufacturer throughout the facility. Multiple manufacturers of any one item shall not be permitted, unless approved in writing by the COR.
- G. These specifications are materials and performance specifications. Actual installation shall be as indicated on the Drawings. Any discrepancies found between the Specifications and the Drawings shall be immediately brought to the attention of the Fort Monmouth COR. Installation and details indicated on the Drawings shall govern if they differ from the Specifications.
- H. Certain terms such as "shall, provide, install, complete, start up" are not used in some parts of these specifications. This does not indicate that the items shall be less than completely installed or that systems shall be less than complete.

- I. Provide all items and work indicated on the drawings and all items and work called for in this specification and in the statement of work. This includes all labor, materials, trenching and excavation, backfilling, compacting, incidentals, equipment, appliances, services, hoisting, scaffolding, supports, tools, test equipment, supervision, consumable items, fees, licenses, insurance, etc., necessary to provide a complete conduit system.

1.2. WORK INCLUDED

- A. This Specification covers the construction of a Telecommunications Outside Plant Conduit system for the U.S. Army Communications and Electronics Command (CECOM), Fort Monmouth New Jersey.
- B. The work covered by this Contract includes the construction described, including all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction. The scope of this work includes, but is not limited to, providing the following:
 - 1 Underground Utilities conduit and fittings made from Smooth-Wall Poly Vinyl Chloride (PVC).
 - 2 Rigid and flexible galvanized steel conduit and associated fittings
 - 3 Cast Concrete Manholes as indicated on the Drawings, Specifications, and Statement of work.
 - 4 All trenching, boring, shoring, sheeting, bracing compacting, concrete encasement, backfilling and landscaping restoration as indicated on the Drawings, Specifications, and Statement of work.
 - 5 All penetrations through walls of manholes and buildings as shown on the Construction Drawings, Specifications, and Statement of work.
 - 6 All supports, adapters, fittings, spacers, solvent cements, etc. necessary for complete and proper installation.
 - 7 All pull cords, warning tapes, cable and conduit tags
 - 8 All inspection and performance testing of conduits and fittings.
 - a All fire stopping of conduits and rated wall penetrations.

- b All sealing of outside plant (OSP) conduits and wall penetrations
- c All necessary Building Department U.S. Army Department of Public Works (DPW) or other filings for permits.
- d All grounding of manholes and conduit systems.

1.3. ABBREVIATIONS AND DEFINITIONS

A. Abbreviations

ANSI	American National Standards Institute
APWA	America Public Works Association
ASTM	American Society For Testing and Materials
AT&T	AT&T OSP Systems 900-200-318
BICSI	Building Industries Consulting Services International
CBM	Certified Blast Manufacturers
CEV	Controlled Environmental Vault
CFR	Code of Federal Regulations
CON	Conduit
EIA	Electronic Industries Association
EPA	Environmental Protection Agency
ETL	Electrical Testing Laboratories, Inc.
FCC	Federal Communications Commission
FM (FMS)	Factory Mutual (Factory Mutual System)
FS	Federal Specifications
FT	Feet
IEEE	Institute of Electrical and Electronic Engineers

IES/NA Illuminating Engineering Society of North America

IPCEA International Power Cable Engineers Association

MH Manhole

NEC National Electric Code

NEMA National Electrical Manufacturers Association

NESC National Electrical Safety Code

NETA National Electrical Testing Association

NFPA National Fire Protection Association

OEM Original Equipment Manufacturers

OSHA Occupational Safety and Health Administration

REA Rural Electrification Administration

RUS Rural Utilities Service

TIA Telecommunications Industries Association

U.L. Underwriters Laboratories

A. Definitions

- 1 "PROVIDE" means to "Furnish" and "Install".
- 2 "INSTALL" means to join, unite, fasten, link, attach, set up or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation, the particular work referred to.
- 3 "FURNISH" means to purchase and supply all materials, labor, equipment, testing apparatus, controls, tests, accessories and all other items customarily required for the proper and complete application for the particular work referred to.
- 4 "AS DIRECTED" means as directed by the Architect/Fort Monmouth COR, or his representative.

- 5 "CONCEALED" means embedded in masonry or other construction, or installed underground.
- 6 "EXPOSED" means not installed underground or "CONCEALED" as defined above.
- 7 "SUBMIT" means submit to Fort Monmouth COR for review. Refer to Architectural General and Special Conditions for proper procedures.
- 8 "APPROVED" means as accepted and authorized, in writing, by the Owner or Fort Monmouth COR.
- 9 SUBSURFACE STRUCTURE means something located underground that is constructed, as a building or work of civil engineering.
- 10 "OWNER" means Fort Monmouth COR
- 11 "CONSTRUCTION MANAGER" (CM) means DPW.
- 12 "ENGINEER" means FORT MONMOUTH COR.

1.4. SUBMITTALS

- A. Submit all shop drawings, manufacturer's data, samples and test reports as called for herein.
- B. Warranty all portions of the work against faulty and improper material and workmanship for a period of five (10) years from date of final acceptance by CECOM/DPW, except that where warranty or warranties for longer terms are specified, such longer terms shall apply.
- C. Submit manufacturer's product data sheets for all material and equipment products proposed in TEP. Provide physical samples of products if directed by Owner or Fort Monmouth COR. TEP shall not be considered without a complete product data submittal.
- D. Within fifteen (15) working days after notice to proceed by the Owner or Construction Manager or after execution of Owner/Contractor Agreement, submit to the Fort Monmouth COR for review a complete typed list of all equipment manufacturers and material suppliers for the equipment intended to be furnished and installed on this project as well as names of all subcontractors, whom the contractor proposes to employ, if any.

- E. Submit shop drawings for approval (30) days prior to start notice to proceed and prior to ordering of material to consist of one (1) set of reproducible and three (3) sets of prints of drawings, diagrams, and/or manufacturer's data in accordance with the contract documents.
- F. At completion of installation, furnish a complete set of as-built documents, including plan view and elevation drawings. As-built drawings shall consist of one (1) set of reproducible, three (3) sets of prints, and the most current release set of Auto CADD diskettes.
- G. All conduit and manhole shop drawings approved by the Fort Monmouth COR shall be submitted for approval by the contractor to a registered Professional Engineer licensed in the State of New Jersey for their approval prior to construction.

1.5. MAINTENANCE

- A. Provide maintenance data for all equipment and materials furnished under this Division. Maintenance data to include:
 - 1 Certified Record Drawings and "Final Reviewed" Shop Drawings.
 - 2 Parts list.
 - 3 Manufacturers' recommended maintenance instructions.
 - 4 List of spare parts recommended for normal service requirements.
 - 5 Assembly and disassembly instructions with exploded view drawings where available.

1.6. RECORD DRAWINGS

- A. Maintain on a daily basis at the project site a complete black and white set of "As - Built Drawings", reflecting an accurate dimensional record of all deviations between work shown on drawings and that actually installed.
- B. Record dimensions clearly and accurately to delineate the work as installed; suitably identify locations of all equipment by at least two dimensions to permanent structures.
- C. Upon completion of the installation, obtain from the Fort Monmouth COR a complete set of mylar transparencies on heavy gauge film with Engineer's seal and firm name removed. Enter thereon, in a neat and accurate manner, a complete record of all revisions of the original drawings, as actually installed. Bear the cost for

transparencies and for making required changes. Submit one (1) set of black and white prints of these revised transparencies to the Fort Monmouth COR for review of completeness. After review by the Fort Monmouth COR, make necessary changes to transparencies and then deliver them to the Fort Monmouth COR for transmittal to the Owner. Fort Monmouth COR will not review these drawings for accuracy nor will the Fort Monmouth COR bear any responsibility for accuracy or completeness.

- D. Mark all As-Built Drawings on the front lower right hand corner as follows:
 - "AS-BUILT DRAWINGS" (3/8" high letters)
 - To be used for recording Field Deviations and Dimensional Data Only". (5/16" high letters).
- E. The Record Drawings will also consist of a set of prints of the final "Signed Off" Contractor's "Coordination Drawings" prepared by the Subcontractors.

1.7. ALTERNATIVE MATERIALS AND EQUIPMENT

- A. Other manufacturers are subject to the review and approval of the DCI Fort Monmouth COR.
- B. Submit proposals to supply alternative materials or equipment, in writing, to the Fort Monmouth COR and TCOR minimum (15) days prior to the date equipment must be ordered to maintain project schedule.

- 1 A description of the difference between the contract requirements and that proposed, the comparative features of each and the effect of the change on the end result performance. Include the impact of all changes on other contractors and acknowledge the inclusion of implementation costs.
- 2 A list of the contract requirements that must be revised if the change is accepted, including any suggested specification revisions.
- 3 Include a description and estimate of costs the Owner may incur in implementing the change, such as test, evaluation, operating and support costs.
- 4 A projection of any effects the proposed change would have on collateral costs to the Owner.
- 5 A statement of the time by which a contract modification accepting the change must be issued, noting any effect on the contract completion time or the delivery schedule.
- 6 A statement indicating the reduction to the contract price if the Owner accepts the change. Be responsible for appropriate modifications to all trades.
- 7 Include all revisions required to adapt alternatives in such proposals, including revisions by other trades. No increase in the contract price will be considered to accommodate the use of alternative equipment.
- 8 The substitution must fit into available space conditions and must function properly in coordination with the rest of the system.

1.8. REVIEWS

- A. Fort Monmouth COR's review is for general compliance with the design concept and contract documents. Markings or comments or the lack thereof do not relieve the Contractor from compliance with the project plans and specifications. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing his work in a safe manner, and for coordinating his work with that of other trades.
- B. No part of the work shall be started in the shop or in the field until CECOM, DPW and Engineers have reviewed the shop drawings and samples for that portion of the work.

- C. A minimum period of ten (30) working days, exclusive of transmittal time, will be required in the Fort Monmouth COR's office each time a shop drawing, product data and/or samples are submitted for review. This time period must be considered by the Contractor when scheduling his work.

1.9. RESPONSIBILITY FOR EVALUATION

- A. The Fort Monmouth COR makes no representations, regarding the character or extent of the subsoils, water levels, existing structural, mechanical and electrical installations, above or below ground, or other subsurface conditions which may be encountered during the work. This Contractor must make his own evaluation of existing conditions which may affect methods or cost of performing the work, based on his own examination of the facility or other information. Failure to examine the drawings or other information does not relieve the Contractor of his responsibility for satisfactory accomplishment of the work.

1.10. QUALITY ASSURANCE

- A. Comply with the requirements of the US Army, FIPS-PUBS, National Electrical Code, National Electrical Safety Code C2-1997 (NESC) , OSHA, the Rural Utilities Service (RUS) of the USDA, ANSI/EIA/TIA, AT&T Outside Plant Systems 900-200-318 October 1996, Building Industries Consulting Services International (BICSI) and the standards, recommendations, rules, regulations and requirements of the Federal Communications Commission. Comply with current governing codes, ordinances and regulations, as well as with requirements of the utility companies serving the campus.
- B. All equipment shall be equal to or exceed the minimum requirements of, NEC, NESC (C2-1997) IEEE, ASME, ANSI, RUS, NFPA and UL.
- C. Comply with the requirements of agencies or authorities having jurisdiction over any part of the work and secure all necessary permits.
- D. Plans, specifications, codes and standards are minimum requirements. Where requirements differ, apply the more stringent. Where there are ambiguities, refer to the Fort Monmouth COR for interpretation.
- E. Should any change in plans or specifications are required to comply with governing regulations, notify the Fort Monmouth COR at the time of submitting this TEP.
- F. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, workmanlike manner by competent workmen. Provide a competent,

experienced full-time Foreman with a minimum of seven years of related experience who is authorized to make decisions on behalf of the Contractor.

1.11. SITE VISIT

- A. Prior to TEP submission, the Contractor shall survey the site and examine the drawings of utilities and other trades as required to determine the existing design conditions that may affect the work. The Contractor shall be held responsible for any assumptions in regard thereto.
- B. The Contractor shall verify all dimensions and distances in the field and document conduit lengths and materials to be furnished and installed. The provision and installation of non-specified miscellaneous hardware, i.e., nuts, bolts, couplers, reducers, adapters, etc., shall also be the Contractor's responsibility.
- C. Existing Construction Documents for the site be made available for review by the Owner/ Construction Manager.
- D. Follow existing site and construction drawings. Investigate the site, structural and finish ground conditions affecting the work, and arrange the work accordingly. Provide such work and accessories as may be required to meet such conditions, at no additional cost to the project.
- E. The locations of existing utilities indicated on the drawings must be verified by the contractor prior to commencing work. Any significant changes to the design necessary to meet field conditions shall be brought to the immediate attention of the Owner ,CM and the Fort Monmouth COR. Contractor shall receive written approval before such alterations are made. All such modifications shall be made without additional cost to the Owner.

1.12. REMOVAL OF BURIED BOULDERS ANY OTHER LARGE DEBRIS

- A. In the event that large buried obstructions, such as boulders, are encountered, the Contractor shall provide a pricing schedule indicating rippable and non- -rippable rock excavation costs.

1.13. DELIVERY, DRAYAGE AND HAULING

- A. Include all drayage, hauling, hoisting, shoring and placement of equipment specified herein. Be responsible for the timely delivery and introduction of equipment to the project as required by the construction schedule for this project. If any item of equipment is received prior to the time it is required, be responsible for its proper storage and protection until such time as it may be required. Pay for all costs of demurrage or storage.

- B. If any item of equipment is not delivered to or installed at the project site in a timely manner as required by the project construction schedule, be solely responsible for disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc. No additional cost or delays to be incurred by the Owner.

2.0 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. Provide complete conduit system with basic equipment as shown on Drawings, specifications, and Statement of Work, including but not limited to sweeps, couplings, adapters, sleeves, bushings, cement, supports, spacers, concrete, fire stops, etc.
- B. If products and materials are specified or indicated on the Drawings for a specific item or system, use those products or materials. If products and materials are not listed in either of the above, use first class products and materials, subject to approval of the Fort Monmouth COR.
- C. Provide products and materials that are new, clean, free of defects and free of damage and corrosion.
- D. All products and materials used in this project will not contain asbestos, P.C.B.'s or any other material, which is considered hazardous by the Department of Environmental Protection, or any other agency having jurisdiction.

2.2 COMPONENT SPECIFICATIONS

- A. Any Part numbers listed in this section have been coordinated with the latest manufacturers product literature, and are accurate at the time of writing. They are, however, subject to change by the manufacturers at any time. If a specific part number is invalid, provide product from same or approved manufacturer meeting component description.
- B. Subject to compliance with technical requirements of these specifications, the contractor may provide equipment, as noted, from the manufacturers listed below. Upon evaluation and prior, written approval by the Fort Monmouth COR, products of other manufacturers may be considered equal provided they meet all performance, dimensional and material requirements specified.

2.3 APPROVED MANUFACTURERS

- A. Schedule 40 Multi-Cell Poly Vinyl Chloride (PVC) Conduit with Rigid Sweeps and Fittings
 - 1 Carlon Systems
 - 2 Or approved equal
- B. Schedule 40 PolyVinyl Chloride (PVC) Conduit, Sweeps and Fittings
 - 1 Carlon Telecom Systems
 - 2 Or approved equal
- C. Galvanized Steel Conduit with Multi-Cell Poly, Vinyl Chloride (PVC) innerducts and Spin couplings, with Flexible or Rigid Sweeps and Fittings
 - 1 Carlon Telecom Systems
 - 2 Or approved equal
- D. PVC coated Galvanized Steel Conduit with corrosion - resistant supports, bolts straps screws, etc, with threaded Rigid Sweeps and Fittings. Must comply with NEC Article 346
 - 1 Perma-Cote or approved equal
- E. Entrance Conduit to Manholes and Buildings (where specified on Construction Drawings and/or SOW).
 - 1 Carlon Telecom Systems
 - 2 Perma-Cote or approved equal
- F. Cast Concrete Manholes
 - 1 Lakelands Precast, Inc.
 - 2 Coastal Pipeline Products Corporation

G. Controlled Environment Vaults

- 1 Rohn, Inc. Or Approved Equivalent

2.4 CONDUITS AND FITTINGS FOR UNDERGROUND INSTALLATION

- 1 4" ID Conduit Schedule 40 Rigid Non – Metallic conduit

Provide Carlon Product No. 49015 or Approved Equivalent.

- 2 Conduit for Optical Fiber. Along shoulder of roadways and across grass non-traffic areas, shall be prelubricated, multi-cell, heavy walled PVC conduit consisting of (4) 1.194" ID PVC innerducts (multiduct) inside of each 4.5" OD "Schedule 40" conduit. Innerducts (multiduct) and heavy walled conduit must be of the same material and shall have the same expand and contraction rate.

Provide Carlon Product No. MFSS-4S-020 or Approved Equivalent.

- 3 4" I.D. UL Listed PVC coated Galvanized conduit where the PVC is listed as the primary protection. To be used for optical fiber and copper cables across roadways, traffic areas and into buildings where indicated on Construction Drawings and SOW. With corrosion - resistant supports, bolts straps screws, etc, with threaded Rigid Sweeps and Fittings. Must comply with NEC Article 346

Perma-Cote or approved equal

- 4 Rigid fiberglass (non-multicell) conduit to be used for bridge crossing applications, 4.50" OD ".

FRE Fiberglass , United Fiberglass of America #140650, or Approved Equivalent

- 5 Rigid fiberglass conduit to be used for bridge crossing applications with Optical fiber. Prelubricated, multi-cell, bullet resistant wall conduit consisting of (4) 1.25" ID PVC innerducts inside of each 4.25" OD " outer fiber glass conduit.

Provide Carlon Product No. MBSS-4S-020 or Approved Equivalent.

- 6 PVC to Galvanized Steel Transition Multiduct Adapters - for transition between metallic & non-metallic multi-cell duct.

Carlson MFAR4 or Approved Equivalent

- 7 PVC to Fiberglass Transition Multiduct Adapters - for transition between Bullet Resistant Fiberglass & PVC multi-cell duct.

Carlson MFAB4 or Approved Equivalent

- 8 Fiberglass to Galvanized Steel Transition Multiduct Adapters - for transition between Bullet Resistant Fiberglass & metallic multi-cell duct.

Carlson MBAR4 or Approved Equivalent

- 9 Female Adapters for non-metallic (PVC) 4 " I.D. conduits to threaded fittings, metallic systems (R.G.S) (non -multi-duct). Female threads on one end, socket end on other.

Carlson E942N or Approved Equivalent

- 10 PVC to Fiberglass Transition non-multicell Adapters - for transition between 4" I.D. Bullet Resistant Fiberglass & PVC Non- Multi-cell duct.

United FiberGlass of America #421445, FRE FiberGlass or Approved Equivalent.

- 11 Fiberglass to Galvanized Steel Transition Non-Multicell Adapters - for transition between 4" I.D. Bullet Resistant Fiberglass & Galvanized non-multi-cell duct.

United FiberGlass of America #145850 or Approved Equivalent

- 12 FiberGlass Expansion Joints - for thermal expansion and contraction of outerduct for multiduct conduit when installed over bridges.

Carlson MBEC4, FRE Fiberglass or Approved Equivalent

- 13 FiberGlass Expansion Joints - for thermal expansion and contraction of non-multicell conduit when installed over bridges.

United FiberGlass of America Inc. # 144050 or Approved Equivalent.

- 14 Galvanized Steel (4) Multi-Cell Terminator kits. Meets duct requirements for air and water integrity use at manholes and building entrances where specified on Construction Drawings. Use with supplied bell fitting at building foundation wall entrances and manholes when specified.

Carlson MFT14 or Approved Equivalent

- 15 PVC (4) Multi-Cell Terminator kits. Meets duct requirements for air and water integrity use at all manholes and building entrances. Use with supplied bell fitting at building foundation wall entrances and manholes.

Carlson MFT14 or Approved Equivalent

- 16 PVC Bell end for non -multi-duct 4 " I.D. PVC conduit. To be used at building foundation wall entrances and manholes.

Carlson E997N or Approved Equivalent

- 17 Meshgrip for PVC Conduit Boring with Back Reamer.

Carlson MAG4 - 4.25-4.487 Meshgrip (7000wk. load) 58" Long or Approved Equivalent for PVC Boring with Back Reamer.

- 18 #10 x 3/4" long hex head stainless steel self tapping screws for providing the additional tensile strength for boring at joint conduit sections as per manufacturers specifications.

Contractors choice

- 19 Steel casting for pneumatic ramming under streets and other substructures. Casing shall be corrosion resistant and shall have a minimum of (100) year life expectancy against corrosion and structural failure after installation. Steel casing shall be 3/8" thick for casing up to 20" O.D and 1/2" thick for steel casings over 20" O.D.

Pneumatic Ramming equipment recommendations for steel casing,
Vermeer or approved equal

- 20 As an alternative to using PVC non- multiduct (4 inner ducts) and multiduct schedule 40 conduit with self tapping screws through steel casings or for directional boring, The following non- cement conduit can be used:

Carlson Bore Gard (non-multiduct) BG440SP-020 and Carlson Borable Multigard MFSS4B-020 (multiduct).

- 21 Conduit, fittings and cement shall be of the same manufacturer. Solvent Cement, all weather quick setting cement for cementing PVC conduit.

Carlson VC 9982 or approved Equivalent.

- 22 Conduit, fittings and epoxy shall be of the same manufacturer, watertight epoxy for cementing fiberglass conduit to prevent joint pullout.

Carlson MA10EK or approved Equivalent (Note: the Manufacturer states that (1) 10 oz container can join up to (6) multicell joints and (10) non-multicell joints.)

- 23 Plug with Pull Tab. For plugging PVC 4" non-multicell conduit at buildings and manholes that do not contain cable.

Carlson P258NT or Approved Equivalent

- 24 Desiccant Gel to prevent gas and water entry via multi-cell and non-multicell conduit into buildings and manholes. To be used to seal conduits installed with cable. The product will be non- toxic, reenterable and requires no special clothing or handling. Contractor shall follow manufacturer's specifications for installation.

Water Guard Desiccants Inc.
Industrial Encapsulant
Caulking tube Gel and pail Gel or Approved Equivalent.

- 25 To create a permanent water seal between the exterior conduit at manhole wall knockouts, and building foundations above surface grade.

Prime Resins Inc.- Prime-Flex 900LVSF liquid polyurethane injection resin or Approved Equivalent.

- 26 Mechanical Sealing Fittings for conduit installed through building foundation walls below surface grade.

O.Z. / GEDNEY Company CSM Sealing Fittings

- 27 Duct spacers. Install to provide stability and consistent separation and relieve direct stress on materials to be encased in concrete. For use with nonmetallic duct, with maximum O.D. dimensions as specified in NEMA TC-2, TC-6, TC-8 and ASTM F512.

Carlson Base Spacer 4 x 3 S288NLN or Approved Equivalent
Carlson Intermediate Spacer 4 x 3 S289NLN or Approved Equivalent

- 28 Beaded straps to secure top row of conduits to base spacer

Carlson S28612 or Approved Equivalent.

- 29 Rebar holders - to secure spacers during concrete encasement

Carlson S28612 or Approved Equivalent

- 30 All empty 4" conduits are to be provided with non-corrosive 5/8" pull rope with tensile strength of 1800 lbs. Each Multiduct raceway (inner duct) shall be provided with a rope made of a white diamond braid construction of polyethylene over polyester designed specifically for fiber-optic pulling. This 1/4" Diameter rope shall support a working load of 260 lbs. and have average tensile strength of 1700 lbs.

Contractors choice

2.5 ELECTRIC METALLIC TUBING (EMT) FOR IN-BUILDING CONDUIT INSTALLATIONS

- A. When the building point of entry is not within the 50 feet of its final termination point EMT conduit will be required to transition OSP conduit to inside plant conduit. Furnish and install where shown on Construction Drawings and indicated in SOW. Conduits must comply with Electrical codes for communication cable installation inside buildings

- 1 Provide Carlson MESS4S-010 - (4) Multicell EMT or Approved Equivalent where multi-cell EMT conduit where shown on Construction Drawings, Specifications and Statement of Work.

- 2 Furnish and install 4" I.D. EMT for non multi-cell conduit where shown on Construction Drawings – Contractors Choice
- 3 Grounding Insulated Bushings: install at each metallic conduit end , one piece , hot dip galvanized malleable iron type with tin plated copper lay in lug with set screw, with insulation molded into and securely locked into fitting. Fittings shall be circular base.

O-Z/ Gedney HBLG Series or Approved Equal

2.6 DETECTABLE MARKING TAPE AND UTILITY MARKERS

- A. Marking shall be 6" wide tape, labeled "Caution Telecommunications Cable Buried Below," Orange color conforming to AWPAC color code specifications for underground marking tape systems.
 - 1 Provide Carlon MAT6061 or Approved Equivalent.
- B. Composite Utility Markers Orange colors conforming to AWPAC color code specifications, temperature and UV resistant will absorb vehicular impacts returning to original upright position. Utility markers shall be 6' long x 3.8" wide with factory installed 2-7/8" wide x 15" long decal on both sides of marker stating " Caution Call Before Digging (Specify Phone Number), Telecommunications Cable Buried Below". Each marker shall also be equipped with an 18" marking line to identify burial depth from base of marker. Decal shall be approved by Owner, DPW and Fort Monmouth COR prior to installation.
 - 1 6' long x 3.8" wide utility marker - Carsonite orange post CIB380 or Approved Equivalent.
 - 2 2-7/8" Wide x 15" Long Decal With 1" High x 1/4" W Black Lettering - Carsonite FOC507 or Approved Equivalent - preinstalled at factory on both sides of utility marker or Approved Equivalent.
 - 3 Installation Tool - To provide quick installation of Utility marker - Carsonite Driver D400R or Approved Equivalent.
 - 4 DeInstallation Tool - To provide quick removal of Utility marker - Carsonite Puller CPP or Approved Equivalent.

2.7 CONDUIT TRENCH PROTECTION

- A. Install 1/4" thick corrosive proof steel plate for top of conduit trench along entire trench run. Plate shall have an A-36 strength rating (36,000 lbs./sq. in.). Plate width shall be determined by the overall conduit width including space between conduits in trench.

2.8 FIRE-STOP

- A. Seal all penetrations through fire rated walls, floors and walls as required by Article 300-21 of the National Electric Code. The sealant material shall have been subjected to fire exposure in accordance with standard, time-temperature curve in the standard, UL ASTM E 119, and NFPA 251. The fire-stop material shall have also been subjected to the hose stream test in accordance with UL LOB.

- 1 Heavy Duty Nelson, IPC or Approved Equivalent.

2.9 MANHOLES

- A. Manholes (MH) may be either precast or cast in place. Most Configurations will be in-line two-way type for straight-through main conduit runs. Multidirectional conduit runs from manholes/ handholes will only be installed for subsidiary conduit to buildings when conduit bend radius is excessive or obstructions prohibit conduit installation outside of manhole. Minimum manhole interior size shall be 12 feet long, 6 feet wide, and 7 feet high, with knockouts and duct terminators arranged for conduit entrances on all four walls. Manholes shall be equipped with cable racks, pulling irons, ladder, entrance collar, frame and cover. Manhole frames and covers shall be bolted down to manhole collar and roof.

Manholes with a minimum concrete strength of 4500 psi shall be placed where specified on drawings and SOW. The interior of each manhole shall have galvanized hardware that includes pulling eyes and struts for wall racks (See Construction Drawings for detail information). Each manhole shall have bonding inserts. All manhole ladders shall be permanently installed and constructed of non-conductive fiberglass. The manhole shall have an E-80 tank carrier loading bearing rate with a minimum 2 feet below grade when placed in the traffic areas. Manholes installed in grass, non- traffic areas shall have a H-20 tractor-trailer loading bearing rate with a minimum of 2 feet below grade. Walls shall be equipped with knockouts to accommodate schedule 40, 4.5" O.D conduits as per Construction Drawings and SOW. Knock-outs quantity and positions shall be as shown on Construction Drawings. Each MH shall also be equipped with a NESC approved grounding electrode, 3/4" diameter, solid material 10' minimum length entering the MH from the floor. The electrode (ground rod) shall extend 6" from interior MH floor grating to facilitate grounding. The electrode shall be driven into a minimum of 7' of earth below floor level.

Precast Manhole Types - According TO AT&T 622-506-100, 919-240-300 Practices, The following manhole configurations shall be used. Construction Drawings shall designate manhole type. See Table 1 for Basic manhole configuration.

TABLE 1 BASIC MANHOLE CONFIGURATION

Basic Manhole Designation	Midsection Designation	Configuration	Number of Sections	Inside Dimensions (FT)			Capacity Fiber Cable per Manhole
				W	L	H	
38Y-4046-1 38Y-4046-2	-----	A,J,L,T	2	6	12	7	80

- 1 A - Type Manholes are two way pass single direction MHS.
- 2 J, L and T - Type Manholes are 2,.3 or 4 way multi-directional way MHS, see Construction Drawings and SOW for details on specific manholes to be used.
 - a Lakelands Precast, Inc., Lima, New York product
 - b Coastal Pipeline Products Corporation
 - c Approved equivalent

2.10 Sealant and Coating for Precast Concrete

- A. For self sealing joints in concrete manholes
 - 1 ConSeal CS-202 or Approved Equivalent.
- B. Provide moisture insensitive, protective dampproof, waterproofing. Emulsified asphalt dampproofing compounds coating for exterior concrete surface of manholes
 - 1 Hydrocide 600,700, and 700B- Emulsified Asphalt Dampproofing Compound or Approved Equivalent.

2.11 Manhole Water-Proof Membrane with Locking Device.

- A. Keeps water and contaminates out of manhole by providing a water tight seal.
- B. Integrated with manhole cover and frame.
- C. Provides a keyed locking device to prevent unauthorized entry into manholes.
- D. Manufactured with a factory gasket, no special adhesives, glues, or caulks required for sealing.
- E. Easily installed and removed. (Less than 10 minutes for each procedure).
 - 1 Barton Southern Company - LockDown-LockDry System or Approved Equivalent for 36" Manhole Frame.

2.12 CONTROLLED ENVIRONMENT COMMUNICATIONS VAULT (CEV)

- A. Furnish and install a prefabricated, above ground building to house communications cable terminations and equipment where shown on drawings, as indicated in specifications, and Statement of work, with all required insulation, fittings and finishes, power, lighting, fire suppression and HVAC equipment, cable supports, relay racks, grounding, etc.
- B. The shelter shall have outside finished dimensions of 36'-0" L X 12'-0" W X 9'-8" H minimum unless otherwise specified.
- C. The structure shall be constructed of precast solid, lightweight concrete, 4" thick, reinforced with deformed steel rebars. The shelter shall be designed and constructed to withstand 30/06 rifle fire at 15 feet distance per UL 752 standards, and for the most stringent (Zone 4) earthquake conditions per ASCE 7-88. the shelter will have a 2 hour fire rating per UBC and will be virtually waterproof and maintenance free
- D. Foundation
 - 1 The foundation shall be an elevated pier foundation of poured-in-place, 3000 PSI, steel bar-reinforced concrete.
 - 2 Foundation to have outside dimensions of 10' 11" W and 9 " less than the outside shelter length
 - 3 Bottom of foundation shall be extended to bear on undisturbed soil below the frost line.
- E. Structural
 - 1 The building floor shall be an 8" waffle structural precast concrete section, ribbed at 2' O.C. on transverse and 4' O.C. longitudinally, with a uniform distributed load capacity of 200 PSF. The floor will be equipped with (2) floor slots for (12) telecom conduits in each and (1) 6 inch slot for electrical power conduit entry.
 - 2 Floor surface shall be covered with 12" X 12" X 1/8" vinyl floor covering bonded with waterproof contact adhesive.
 - 3 Roof shall be concrete with 1/8" per foot pitch, sloping in 4 directions and overhanging sidewalls by a minimum of 2" on each side. Roof shall cap all walls and leave no exposed joints.

- 4 Roof shall have a increased roof load of 150 PSF.
- 5 Ceiling insulation to be 1" foamboard (R-19) covered with 3/8" vinyl coated board finish.
- 6 Wall insulation to be 1" foamboard covered with 3/4" plywood board surfaced with fiberglass reinforced plastic (R-11).
- 7 Wall sections shall be 4" solid concrete, cast in one piece to minimize joints, with exteriors form liner cast to simulate brick finish. Walls shall have a basic wind speed design loading capacity of 115 mph per ASCE 7-88.
- 8 Walls shall overhang floor by a minimum of 7" from the finished floor surface without exposed joints.
- 9 All openings for the door, AC units, ductbank entries, etc. shall be cast-in-place.

F. Fixtures and Fittings

- 1 Building shall be fitted with an outward opening, 72" X 84", 18 gauge galvanized steel door, set in a 16 gauge galvanized steel frame, primed and painted and furnished complete with door check, door stop, weatherstripping, mortise lockset and stainless steel ball bearing hinges. Door shall be bullet resistant.
- 2 Building shall be provided with overhead ladder type cable runway, relay racking, rack mounting wire managers, grounding bar and D-ring cable supports as shown on drawings.
- 3 Cable runway shall be UL classified, 12" horizontal and 36 wide vertical with 1.5" stringers and 9" rung spacing, complete with all splice and junction kits, wall mount and clamp kits, anchors, threaded rod, hanger supports and accessories. Clear film finish.
 - a Chatsworth P/N 11275-012, 36 or equivalent.

- 4 Equipment (Relay) racks shall be EIA-310-C compliant, 6" deep (high density) X 84" high X 19" and 6" wide as shown on drawings; self-supporting aluminum rack with flange footings, mounting holes both sides with standard EIA hole spacing, clear film finish.
 - a Chatsworth P/N 66353-503 (19") or equivalent.
 - b Double Vertical Cabling Section to manage patch cordage between relay racks, 7' H X 6" W X 12.75" D, clear film finish. Chatsworth P/N 11729-503.
 - c Power strip for mounting inside vertical cabling sections, metal, 5' long with (6) single outlets spaced 9" apart, 6' mounting cord. Wiremold P/N G-20-C3 or equivalent.
- 5 Ground bus bar shall be 4" X 1/4" X 20" wall mounted solid copper bar, kit complete with insulators, support brackets and mounting hardware. Chatsworth P/N 10622-020 or equivalent.
- 6 Wire management panels shall be 19" wide rack mount panels (1) rack unit high with integral wire spools. Chatsworth P/N 13070-719 or equivalent.
- 7 Patch panel wire management bar shall be 19" rack mountable for strain relief, black. Chatsworth P/N 12176-701.

G. Environment and Safety

- 1 The shelter shall be watertight and dust resistant.
- 2 The shelter shall be heated and cooled to provide an inside environment of no greater than 78° F and 30-55% relative humidity. Design shall assume equipment loads totaling 30 watts per ft². Provide (2) 48,000 BTU wall mount air conditioners with 5KW heat strips and controls with basic lead/lag controllers installed at factory on end walls.
- 3 Install a FM200 Fire Suppression System including alarms (contact closure devices for remote monitoring), open door, high/low temperature, smoke, HVAC shout-down tied to FM200 auto fire suppression system alarm terminal block all lights and signs as per Fort Monmouth and manufacturers specifications.
- 4 Emergency Lighting – Dual head emergency light with exit sign, battery and charger.

- 5 Exterior light 100 watt incandescent with switch and photo cell.

H. Electrical

- 1 All electrical components, installation and wiring shall conform to the latest edition of the NEC as well as other applicable state, federal and U.S. codes and standards.
- 2 Uninterruptable power shall be provided to all active electronics in the building as well as the environmental systems required to support them.
- 3 50 KW Natural Gas Generator System with 225 amp auto transfer switch. The generator set shall meet Fort Monmouth Directorate of Public Works (DPW) Generator Standards (see attached document).
- 4 Provide a 42 circuit primary load center. 120/208 VAC three phase, 60 Hz operation, 200 amp main breaker, required breakers, LB power entry, required duplex outlets, and (1) exterior GFI outlet. Provide a disconnect switch exterior fused 200 amp three phase. Provide lightning arrestor, Innovative technology Model P3Y1 120/208V
- 5 Power distribution in the room shall be via surface mounted EMT conduit. Provide a minimum of (1) U-ground standard duplex outlet in a surface mounted junction box located at 18" AFF and spaced every 4 feet along three walls of the room.
- 6 Provide fluorescent downlights sufficient to achieve 50 foot candles of light maintained at 3 feet AFF. Coordinate placement with overhead cable tray. Install (8) 4' dual bulb florescent lights with switch.
- 7 Manufacturer
 - a Rohn, Inc. Or Approved Equivalent

3.0 EXECUTION

3.1 FEES

- A. Pay all required fees, including any royalties or fees required in connection with the use of patented devices and systems.
- B. Provide controlled inspection where required by local authorities or by these specifications.

3.2 CONTRACTOR'S COORDINATION DRAWINGS

- A. Coordinate efforts of all trades and furnish, in writing, any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.
- B. Prepare a complete set of construction Coordination Drawings indicating the equipment actually purchased, the exact routing for all conduit, the location of manholes, conduit embedded in concrete, galvanized steel conduit sections and service entrance conduit. Indicate all work routed underground and embedded in concrete by dimension to column and building lines. Have Coordination Drawings signed-off by the Fort Monmouth COR and DPW prior to the installation of the work in the area covered by the specific drawing.
- C. This requirement for Coordination Drawings is not authorization for the Contractor or Subcontractor to make any unauthorized changes to the Contract Drawings.
 - 1 Work installed which interferes with work of any other trade or utility will be corrected at no cost to the project.
 - 2 Follow manufacturers' instructions for installing, connecting, and adjusting equipment. Provide one copy of such instructions to the Fort Monmouth COR before installing any equipment. Provide a copy of such instructions and attach to the equipment during work on the equipment.
 - 3 Contact local Manufacturers Representative to provide additional technical support during installation and when ordering material. (Ken Konya Brazill Brothers (732) 906-3500)

3.3 COORDINATION OF WORK

- A. Furnish and set galvanized steel sleeves for passage of conduits through structural masonry and concrete walls and floors and elsewhere as may be required for the proper protection of each conduit passing through building surfaces.
- B. Properly provide fire stopping around all pipes, conduits, ducts, sleeves, etc., which pass through rated walls, partitions and floors.
- C. Provide detailed information on openings and holes required in precast members and sealing bushings for conduit work.
- D. Provide required supports and hangers for conduit and equipment, designed so as not to exceed allowable loadings of structures.
- E. Examine and compare the contract drawings and specifications with the existing site drawings and drawings and specifications of other trades, report any discrepancies between them to the Fort Monmouth COR and obtain written instructions from the Fort Monmouth COR for any changes necessary in the work. Install and coordinate the work in cooperation with other related trades. Before installation, make proper provisions to avoid interferences.
- F. Coordinate as required with the local Telephone Exchange Carrier and local Cable Television franchised carrier as to their requirements for service connections and provide all necessary materials, equipment, labor and testing.

3.4 TESTING

A. Test holes

- 1 In built up areas where the possibility of undisclosed subsurface conditions exist, provide test holes to verify that the construction can be carried out as planned and to avoid useless excavation. Dig test holes (1) foot deeper than the depth of the proposed excavation. If foreign pipes or other structures are encountered in the test holes, inform Fort Monmouth COR and CM immediately, to determine their ownership of the structure. If the structure cannot be removed, a decision will be made by the Owner and Fort Monmouth COR whether to relocate trench and/or manhole.

B. Soil Testing

- 1 Prior to using on site and /or imported soil materials the contractor shall employ a recognized soils laboratory to secure samples, perform the necessary laboratory analysis, and establish the compaction and other criteria necessary for the proper placement of backfill. A report of the laboratory findings, including the compaction specifications shall be submitted to the township and DPW engineers for review and approval prior to commencing any backfill operations using on site soil and /or imported soil materials.

C. Backfill Compaction Certification

- 1 During the backfilling, the contractor engaged in a backfilling operation shall employ a professional engineer, licensed in the State of New Jersey, who is regularly engaged in the practice of geotechnical engineering and who is trained in soil mechanics, to observe the placement of the backfill. The engineer indicating the results of the compaction, and on the conclusion of the project, file certification indicating that the backfill material has been placed and compacted in accordance with the recommendations contained in the approved laboratory report.

3.5 Excavation

- A. Provide excavation outside the buildings as shown on drawings. Excavate all material encountered to the depths indicated on the drawings or required. Remove from the site excavated materials not required or unsuitable for backfill. Provide grading as may be necessary to prevent surface water from flowing into trenches or other excavations. Remove any water accumulating therein. Provide sheeting and shoring as may be necessary for the protection of the work and for the safety of personnel as required by OSHA and other applicable codes.

3.6 SHORING

- A. The Occupational Safety and Health Act (OSHA) requires that: All excavations deeper than 5 feet which workers are required to enter and work, shall have walls shored, sheeted, braced, or otherwise supported, unless the excavation is in solid rock, hard shale, hard slag or where the side walls are cut to a slope of 1 foot horizontally for each 2 feet of rise. Trenches less than 5 feet shall also be shored if they constitute a hazardous work location. A qualified member of the work crew shall be stationed on the surface to keep the workers in the excavation in sight at all times. See Table 1 for minimum shoring requirements. The Contractor is responsible for obtaining soil testing to determine shoring requirements. All soil test results shall be documented and submitted to Owner and Engineer for review prior to construction.

TABLE 1 MINIMUM SHORING REQUIREMENTS

TRENCH SHORING – MINIMUM REQUIREMENTS (Wood Member Dimensions in Inches)								
Trench Depth (ft)	Soil (Note 1)	Uprights		Stringers (Note 2)	Cross-Braces for Trench Width up to (Note 3)			
		Size	Spacing (ft)		6 ft	9 ft	12 ft	15 ft
5 to 10	A	3 x 4	6	None	4 x 4	4 x 6	6 x 6	6 x 8
		or						
		2 x 6						
	B		3	4 x 6				
	C		Tight	4 x 6	4 x 6	6 x 6	6 x 8	8 x 8
	D		Tight	6 x 8				
10 to 15	A	3 x 4	4	4 x 6	4 x 6	6 x 6	6 x 8	8 x 8
		or						
		2 x 6						
		3 x 6						
	B		2	4 x 6				
	C		Tight	4 x 6	6 x 6	6 x 8	8 x 8	8 x 10
	D		Tight	8 x 10				

**CONDUIT, MANHOLE AND CEV
SPECIFICATION**

**DEPARTMENT OF THE ARMY
DIRECTORATE FOR CORP. INFO CECOM
FORT MONMOUTH, NEW JERSEY**

15 to 20	All	3 x 6	Tight	4 x 12	6 x 8	8 x 8	8 x 10	10 x 10
>20	All	3 x 6	Tight	6 x 8	8 x 8	8 x 10	10 x 10	10 x 12
<p>Notes:</p> <ol style="list-style-type: none">1. Soil type or condition: A – Hard, compact B – Likely to crack C – Soft, sandy, or filled D – Hydrostatic pressure.2. Stringer spacing = 4 ft.3. Cross-braces spaced 4 ft. vertically, 6 ft. horizontally.4. All associated shop drawings shall bear the seal of a registered Professional Engineer licensed to practice in the State of New Jersey.5. Trench jacks may be used in lieu of, or in combination with, cross- braces.								

**Issued as Master Outside Plant Specification
May 7, 2002**

**Telecommunications
Outside Plant Pathway Systems**

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3.7 TRENCHES AND BACKFILL

- A. Provide trenches of widths necessary for the proper execution of the work. Grade bottom of the trench accurately to provide uniform bearing and support to the work on undisturbed soil at every point along its entire length. Except where rock is encountered, do not excavate below the depths indicated. Where rock excavations are required, excavate rock to a minimum overdepth of four inches below the trench depths indicated on the drawings or required. Backfill overdepths in the rock excavation and unauthorized overdepths with loose, granular, moist earth, thoroughly machine tamped to a compaction level of at least 95% to standard proctor density or 75% relative density. Whenever unstable soil that is incapable of properly supporting the work is encountered in the bottom of the trench, remove soil to a depth required and backfill the trench to the proper grade with well graded sand, fine gravel or other suitable material. The Fort Monmouth COR, or other Owner's representative must be on site for all related operations. The Contractor is required to provide a minimum of 24-hours advance notice to Owner/DCI/DPW Fort Monmouth COR.
- B. Do not place trenches within ten feet of foundation or soil surfaces which must resist horizontal forces.
- C. Do not backfill trenches until all required tests have been performed and the installation observed by the Fort Monmouth COR. Backfill should consist of non-expansive soil with limited porosity. Deposit in 6 inch layers and thoroughly and carefully tamp until the work has a cover of not less than 1 foot. Backfill and tamp remainder of trench at 12 inch intervals until complete. Uniformly grade the finished surface. All backfill within 6 inches of the conduit or manhole structure shall be free of solid material greater than 4 inches in maximum dimension or with sharp edges likely to damage it. Debris, such as wood stumps and other low structure waste, shall not be permitted to be used in backfill.
- D. Excavate trenches for ductbanks to the width of the duct structure plus 4 inches on each side. Trench depth shall provide for minimum 36 inches earth cover above top of duct structure, from existing grade or from indicated finished grade, whichever is lower. All conduit encased in concrete shall have minimum of 3 inches of concrete at the top and bottom and three inches on each side. A horizontal and vertical separation between the ducts of 3 inches shall be maintained by installing high impact spacers with horizontal and vertical locking at intervals of 10 feet.

- E. Underground conduit shall be installed such that a slope exists at all points of the run to allow drainage and prevent the accumulation of water. Install conduit such that a drain slope of no less than .125 inches per foot when extending conduit away from building structures. When installing conduit between manholes, a slope of .125 inches per foot shall extend from the middle of the span to each manhole.
- F. Excavate trenches for manholes to the external dimensions of the manhole plus 4 inches for shoring. Excavate the manhole floor to the thickness of the floor plus 4 inches. Add crushed stone for drainage below all manhole floors.
- G. Following the backfill placement but prior to any replacement of any grass, sod or repaving, install drag lines in all conduits and inner ducts and clean of loose materials, such as concrete, stones, mud, dirt, etc.
- H. Conduit Trench Protection
 - 1 Install 1/4" thick (see engineering drawings for width of plate) corrosive proof steel plate above the conduit trench along entire run. The plate shall have an A-36 strength rating (36,000 lbs./sq. in.) and be located in the center of the trench at a minimum depth of 12" from the surface grade.

3.8 DUCT INSTALLATION

- A. General
- B. Conduit systems should be subject to the least disturbance practical. Conduit systems extending parallel to other subsurface structures should not be located directly over or under other subsurface structures. If this is not practical, follow the rule on separation, as stated in this section.
 - 1 Align conduits so that there are no protrusions that would be harmful to the cable.
 - 2 Furnish PVC conduit in 20-foot lengths. Furnish galvanized steel conduit in 10-foot lengths.
 - 3 Limit the maximum change of direction in any plane between lengths of straight rigid conduit without the use of bends to 5 degrees.

- 4 Identify duct and fittings for type and manufacturer, traceable to plant location, date, shift and machine of manufacture. The markings shall be legible and permanent.
- 5 Test duct and fittings in accordance with NEMA and ANSI/ASTM requirements.
- 6 Provide bends at 96" radius minimum for Multi-cell bends which shall be equipped with cut through resistant inner ducts meeting the size and performance requirements of the multi-cell conduit provided. Provide Carlon Multi-Gard and Schedule 40 Duct Sweeps or Approved Equivalent.
- 7 Provide bends at 96" radius minimum for 4" ID non Multi-cell PVC Conduit to be used for future cable installation. Schedule 40 Duct Sweeps or Approved Equivalent.
- 8 Use slip couplings only for male/male connections where space is limited. Use standard couplings at all other male/male connections.
- 9 Provide protective caps on all spigot ends and belled ends.

C. Natural hazards

- 1 Routes through unstable soils, such as mud, shifting soil, etc., or through highly corrosive soils, should be avoided. If construction is required in these soils, install conduit in such a manner as to minimize movement or corrosion or both.

D. Precautions

- 1 Check all excavations for gas leakage, even if gas mains or sewers are not directly encountered. No open flame of any sort shall be permitted around excavations.

E. Highways and Streets

- 1 When conduit must be installed under roadway, install in the shoulder or, to the extent practical, within the limits of one lane of traffic.

F. Bridges and Tunnels

- 1 Locate the conduit system so as to limit the likelihood of damage by traffic. It should be located to provide safe access for inspection or maintenance of both the structure and the conduit system.
- 2 Conduit installed in bridges shall include the capability to allow for expansion and contraction of the bridge (i.e. expansion fittings as recommended by the manufacturer).
- 3 Install conduits passing through a bridge abutment so as to avoid or resist any shear due to soil settlement.
- 4 Effectively ground all conduit of conductive material installed on bridges.
- 5 Conduit installed over bridges shall be galvanized steel or fiber glass, PVC outer conduit shall not be installed

G. Crossing Railroad Tracks

- 1 Do not locate the top of the conduit system less than 900mm (36 in.) below the top of the rails of a street railway or 1.27 m (50 in.) below the top of the rails of a railroad. Where unusual conditions exist or where proposed construction would interfere with existing installations, a greater depth than specified above may be required.
- 2 Subject only to prior written approval, this separation may be reduced by agreement between the parties concerned. In no case, however, shall the top of the conduit or any conduit protection extend higher than the bottom of the ballast section that is subject to working or cleaning.
- 3 Do not locate manholes, handholes or vaults in the roadbed at crossings under railroads.

H. Submarine Crossing

- 1 Route and install submarine crossings so they will be protected from erosion by tidal action or currents and shall not be located where ships normally anchor.

I. Separation from Other Underground Installations

- 1 The separation between a conduit system and other underground structures paralleling it should be as large as necessary to permit maintenance of the system without damage to the paralleling structures. A conduit that crosses over another subsurface structure shall have a separation sufficient to limit the likelihood of damage to either structure.
- 2 Separate conduit systems to be occupied by communications cabling from conduit systems to be used for electrical systems by a minimum of:
 - a 75mm (3 in) of concrete.
 - b 100mm (4 in) of masonry
 - c 300mm (12 in) of well-tamped earth

J. Sewers, Sanitary and Storm

- 1 If conditions require a conduit to be installed parallel to and directly over a sanitary or storm sewer, prior review and approval of the method to be used is required by the Owner and DPW and DCI Fort Monmouth COR before construction commences.
- 2 Where a conduit run crosses a sewer, provide suitable support on each side of the sewer to prevent the transfer of any direct load onto the sewer.

K. Water Lines

- 1 Install conduit as far as is practical from a water main in order to protect it from being undermined if the main breaks. Design conduit that crosses over a water main to have suitable support on each side as required to prevent the transfer of any direct loads onto the main.

L. Fuel Lines

- 1 Provide separation between conduit and fuel lines sufficient to permit the use of pipe maintenance equipment. Conduit and fuel lines shall not enter the same manhole.
- 2 The following minimum separation from fuel lines is:

- a 20 feet overall.
- b 40 feet at fueling stations.

M. Steam Lines

- 1 Install conduit so as to limit the likelihood of detrimental heat transfer between the steam and conduit systems. Conduit systems external temperature shall not exceed 120 degrees Fahrenheit.

N. Crossing Mains

- 1 Cross under gas, steam or water mains rather than above them provided, however, that the depth of the trench shall not exceed 3 feet below bottom of original excavation. Avoid a paralleling position either above or below gas, steam or water mains.

O. Ducts and Joints

- 1 Provide duct material that is corrosion-resistant and suitable for the intended environment.
- 2 Duct materials, the construction of the conduit, or both shall be such that a cable fault in one duct would not damage the conduit to such an extent that it would cause damage to cables in adjacent ducts.
- 3 The internal surface of the duct shall be continuous and free of sharp edges or burrs which could damage cable.
- 4 Chemically weld all joints in plastic conduits as per manufacturer's specifications.
- 5 Join ducts in a manner so as to prevent solid matter from entering the conduit lines.

P. Restraint

- 1 Conduit, including terminations and bends, should be suitably restrained by backfill, concrete enveloped, anchors, or other means to maintain its design position under stress of installation procedures, cable pulling operations, and other conditions such as settling and hydraulic or frost uplift.

Q. Externally Coated Pipe

- 1 When conditions are such that externally coated pipe is required, the coating shall be corrosion resistant and should be inspected, tested, or both, to see that the coating is continuous and intact prior to backfill. Precautions shall be taken to prevent damage to the coating when backfilling. Steel conduit shall be PVC coated where the PVC coating is the primary protection, and is UL listed.

R. Building Walls

Furnish and install interior and exterior conduit sealing bushings as per manufacturer's specifications when outside plant conduit enters through building foundation walls below surface grade. Conduit installed through building floor slab shall be provided with internal and external seals sufficient to limit the likelihood of the entrance of gas and water into the building.

S. In Vicinity of Manholes

- 1 Install conduit on compacted soil or otherwise supported when entering a manhole to limit the likelihood of detrimental shear stress on the conduit.

T. Underground Facilities

- 1 Duct structures shall be straight and level between pull points to the greatest extent possible.
- 2 Make directional changes as gradually as possible. Total bends between pull points shall not exceed two 90 degree sweeps with no more than a total of 90 degrees within any 50 feet. Duct bank formations should permit standard cable racking without changing formations as they enter the manhole or building.

U. Conduits, Types

- 1 Below ground in non-traffic areas: rigid non-metallic conduit, Schedule 40.
- 2 Below ground in areas subject to vehicular traffic: Rigid metallic PVC coated galvanized conduit or Schedule 40 rigid non-metallic conduit encased in concrete.
- 3 Inside building if final cable termination point is more than 50 feet from the point of entry, use 4" I.D. EMT multi-cell and non-multicell conduit where specified on Construction Drawings.
- 4 Encase Conduit(s) in Concrete (2,500 PSI) When:
 - a Minimum depth of 36 inches cannot be attained.
 - b Conduits pass under roads, driveways, or railways (or install rigid metallic galvanized conduit if 36 inch minimum depth can be obtained)
 - c Bend points are subject to movement.
5. All empty 4" I.D. conduits are to be mandrilled to ensure clear conduit pathway.
6. All empty 4" I.D. multi-cell conduits shall install drag lines in multicell between each manhole/ handhole and building conduit section per Carlon "Duct Proofing for Cable Pulling" specifications. The pressure test will ensure that the conduit sections are in tact and were not damaged or installed improperly during installation.
7. All empty 4" I.D. conduits will be installed with a noncorrosive 5/8" pull rope with a tensile strength of 1800 lbs. Each multicell raceway (inner duct) shall be provided with a rope made of a white diamond braid construction of polyethylene over polyester designed specifically for fiber-optic pulling. This 1/4" Diameter rope shall support a working load of 260 lbs. and have average tensile strength of 1700 lbs. 15 feet of slack shall be left coiled at each conduit and innerduct end section and tied-off to a permanent fixed object in the MH (i.e., pulling eye).

V. Conduit Termination

1. Use terminator kits supplied with bell fittings meeting duct requirements for air and water integrity with conduits at all manholes and building entrances.

W. Steel Case Bore Under Surface Structures with Pneumatic Rammer

1. Steel case ramming must be done according to the equipment manufacturer's specifications, local and National Electric Safety Codes and Engineering Drawings.
2. The steel casing shall maintain a minimum depth of 5 feet from surface grade. Greater depths may be required in order to avoid existing substructures and utilities.
3. The steel casing and conduit installation shall have support an E-80 (rail road) load rating.

X. For installation of PVC schedule 40 multicell and non multicell conduit through steel casings under surface structures and newly paved streets in line with conduit pathway, use the following procedure:

1. Use meshgrip type pulling grip over capped plain conduit end.
2. Assemble conduit sections of multicell or non-multicell conduit by applying quick -set cement on spigot and bell ends and checking for print alignment.
3. Install #10 hex head self tapping screws (refer with conduit manufacturer for proper screw length and procedure) into bell. Screws will give each conduit joint the tensile strength required for pulling conduit through steel casing.
4. Stagger conduit bell fittings by 2 vertical feet when installed through steel casing.
5. Follow manufacturer's installation and assembly specifications.

- Y. For installation of PVC schedule 40 Borable multicell and non- multicell conduit ((Carlson Bore Gard or Borable Multi-Gard or approved equal) through steel casings under surface structures and newly paved streets in line with conduit pathway, use the following procedure:
1. Use expandable steel pulling eye for open conduit and Kellem's Grip for multi-gard, multiduct conduit, as per ,manufacturer's specifications.
 2. Stagger conduit bell fittings by 2 vertical feet when installed through steel casing.
 3. Follow manufacturer's installation specifications for installation and conduit assembly.
 4. Transition to cement welded schedule 40 trench PVC conduit outside of steel casing as per manufacturer's specifications and Engineering Drawings.
- Z Directional Boring
1. Follow manufacturer's specifications for conduit boring.
 2. Maintain specified distances from existing utilities and substructures.
 3. Conduit boring pathway shall support an E-80 load rating when crossing streets (railroad rating) and an H-20 (tractor trailer) load rating when in grass areas.
 4. Install using this method only where specified on Engineering Drawings.

3.9 Manholes, Handholes, and Vaults

- A. Manholes, handholes, and vaults shall be constructed to sustain all expected loads that may be imposed upon the structure. The horizontal design loads, vertical design loads, or both shall consist of dead load, live load, equipment load, impact, load due to water table, frost, and any other load expected to be imposed upon the structure, to occur adjacent to the structure, or both. The structure shall sustain the combination of vertical and lateral loading that produces the maximum shear and bending moments in the structure.

- B. In vehicular traffic areas, design for a live load equal to the weight of a moving tank carrier (E-80 rating). In grass areas design for a live load equal to the weight of a moving tractor-trailer (H-20 rating). In the case of multilane pavements, the structure shall sustain the combination of loadings, which results in vertical and lateral structure loadings that produce the maximum shear and bending moments in the structure.
- C. When hydraulic, frost, or other uplift will be encountered, the structure shall either be of sufficient weight or so restrained as to withstand this force. The weight of equipment installed in the structure is not to be considered as part of the structure weight.
- D. Provide pulling iron facilities to withstand a minimum of 3600 lbs. applied to the pulling iron.

3.10 Manhole Sealant and Emulsified Asphalt Dampproofing Compounds:

- A. Surface must be clean and free of any dust, oil, grease laitance, curing compounds, or any other contaminants. This can be achieved by shot blasting, waterblasting, or mechanical means.
- B. The concrete must have a minimum tensile strength of 200 p.s.i. The tensile strength shall be tested using the pipe-cap pull-off test described in ACI503r-92 or using an elcometer as described in ASTM D 4541.
 - 1 Minimum age of concrete must be 28 days.
 - 2 Minimum application temperature shall be as recommended by manufacturer.
 - 3 Application Procedure for the Concrete Sealant and Epoxy Resin Coating shall be as per manufacturers specifications. A copy of these procedures shall be submitted to the Fort Monmouth COR and the CM for review prior to application.
 - 4 Apply Concrete Sealant at all self-sealing joints during MH construction.
 - 5 Apply Emulsified Asphalt Dampproofing Compound to the exterior surface of precast manholes prior to installing manholes.

3.11 Manhole Water-Proof Membrane with Locking Device.

- A. Install a water-proof membrane equipped with a locking device in every manhole shown on the Construction Drawings and as indicated in the SOW.

3.12 IDENTIFICATION

- A. Identify conduits at each interior wall of a manhole and building entry point with permanent ink, self adhesive, Nylon tags, displaying 1 inch numbers as indicated on construction drawings.
- B. Warning tape requirements
- C. To minimize any change of an accidental dig-up, place detectable (i.e., containing metallic tracings) warning tape a minimum of 45 cm (18 in.) above the conduit bank.
- D. Each manhole shall have a 36" frame with a cover that is permanently identified as shown on drawings.
- E. Install orange warning posts every 50 feet along conduit route and within 15 feet of each side of roadways.

3.13 CUTTING AND PATCHING

- A. Lay out the work in advance, fully coordinated with existing work of other trades.
- B. Provide core openings through building walls below grade level as required to properly install work. Be responsible to properly locate such openings and provide for any cutting, patching, repairs and water proofing caused by the neglect to do so. Chopping of foundation and manholes is prohibited.

3.14 FIRE STOP - PENETRATION SEALANT

- A. Seal all penetrations through fire rated walls, floors and walls created by or made on the behalf of the contractor so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the National Electric Code.
- B. The sealant material shall have been subjected to fire exposure in accordance with standard, time-temperature curve in the standard, UL ASTM E 119, and NFPA 251. The fire-stop material shall have also been subjected to the hose stream test in accordance with UL LOB.

3.15 FIRE ACCESS TO FIRE APPARATUS

- A. Do not interfere with access to hydrants and fire alarm boxes. In no case allow material or equipment to be within twenty (20) feet of a hydrant or fire alarm box.

3.16 DEMOLITION AND CONTINUANCE OF EXISTING SERVICES

- A. All existing services not specifically indicated to be removed or altered shall remain as they presently exist.
- B. Should any existing services, etc., interfere with new construction, the Contractor shall (after obtaining written approval from the Owner/ DPW and DCI Fort Monmouth COR) alter or reroute such existing equipment to facilitate new construction.
- B. Under no circumstances shall existing services, etc., be terminated or altered unless deemed necessary by the Owner/Fort Monmouth COR or specified herein; also, prior to altering any existing situation, the Contractor shall notify the Fort Monmouth COR in writing giving two (2) weeks advance notice of planned alteration.

- D. It shall be solely the Contractor's responsibility to guarantee continuity of present facilities (with respect to damage or alteration due to new construction) and any unauthorized alteration to existing equipment shall be corrected by the Contractor to the Owner/ DCI and DPW Fort Monmouth COR's satisfaction at the Contractor's expense.

3.17 EQUIPMENT AND MATERIAL PROTECTION

- A. Be responsible for all work, materials and equipment until finally inspected, tested and accepted; protect work against theft, injury or damage; and carefully store material and equipment received on site which are not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material. Cover and protect in an acceptable manner to the Owner, all equipment and materials from damage due to water, spray-on fireproofing, construction debris, etc. Correct all damage thus caused without additional cost to the Owner.

3.18 DATE OF COMPLETION AND TESTING

- A. Comply with the project construction schedule for the date of final performance and acceptance testing, and be complete sufficiently in advance of the Contract completion date to permit the execution of the testing prior to occupancy and the closeout of the Contract. Complete any adjustments and/or alterations which the final acceptance tests indicate as necessary prior to the completion date.

3.19 FINAL REVIEW

- A. At a time designated by the Owner, the entire system shall be reviewed for compliance with the Contract Drawings and Specifications. Be available at all times during this review.

END OF SECTION

DIRECTORATE OF PUBLIC WORKS
FORT MONMOUTH, NEW JERSEY 07703-5109

SELFM-PW

ENGINEERING AND CONSTRUCTION TECHNICAL STANDARD NUMBER 3

SUBJECT: EMERGENCY GENERATION/STANDBY POWER SYSTEMS

1. Purpose: To establish Emergency Generation/Standby Power System Standards for use in the design, construction and maintenance of projects by Directorate of Public Works and Maintenance Contractor personnel.
2. Applicability: This SOP applies to all Engineering & Construction, Master Planning and Facility Management Division personnel as well as Maintenance Contractor personnel .
3. References: National Electric Code.
4. Procedures: Personnel shall apply the following Emergency Generation/Standby Power Systems Standards when designing, constructing or procuring materials for DPW projects.

A. EMERGENCY GENERATION

Emergency electric generating system shall include the following:

Engine-generator control console resiliently mounted on each generating set, shall include complete engine start-stop control and solid-state monitoring system.

Starting batteries with battery charger for each engine-generator set.

Mounted and loose accessories, control devices and other equipment as specified herein and/or as shown on drawings.

Automatic transfer switch and accessories.

Such other components, accessories, parts, tests, documents and services as needed to meet the performance requirements.

System shall include an engine-generator set with accessories, exhaust muffler (s) Critical grade, flanges, and flexible exhaust pipe section sized as required for the engine and installation.

Concrete pad size for generator shall be calculated to include the weatherproof/noise attenuating enclosure measurements, which are substantially larger than the generator measurements alone.

Where noise cannot be controlled sufficiently with critical grade mufflers and sound attenuating enclosures, noise cancellation technology shall be considered and applied if economically and technically feasible.

Coordination with the Planning/Environmental Division shall be performed in the design stage of the project, so that the Air Permits are obtained in a timely manner and do not delay the installation of the equipment.

All new generator installations shall employ natural gas fired generator sets with the lowest emission ratings available for the particular KW rating.

A mandatory load bank test shall be included with each generator installation, consisting of voltage/power/frequency monitoring along with voltage transient monitoring during startup and load pickup. A minimum 2 hour test is required and shall be performed by the generator manufacturer.

Additional circuits shall be included with every generator installation to provide power for water jacket heaters. Usually two 120/240 volt, 20 amp circuits are required for water jacket heaters.

SPARK-IGNITED ENGINE-GENERATOR SET:

A 4-cycle, 1800 RPM, engine generator set with low reactance brushless generator, torque matched excitation, automatic voltage regulator, set mounted control panel and high ambient cooling system (50 degrees C).

Prototype tests shall have been done on a complete and functional unit, component level type tests will not substitute for this requirement.

Voltage regulation shall be plus or minus 2 percent for any constant load between no load and rated load.

The engine generator set shall be capable of single step load pick up of 100% nameplate KW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.

The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified KVA load at near zero power factor applied to the generator set.

Maximum transient voltage dip shall not exceed 25% below rated on application of the single largest surge load step.

AC GENERATOR

The AC generator shall be; synchronous, four pole, revolving field, drip-proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan and directly connected to the engine with a flexible drive disk.

All insulation system components shall meet NEMA MG1 standard temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 105 degrees Centigrade.

The generator shall be capable of full three-phase output.

The generator shall be broad range, 12 lead re-connectable. The generator shall be capable of delivering rated output (KVA) at rated frequency and power factor, at any voltage within the broad range.

A permanent magnet generator (PMG) shall provide excitation power to the automatic voltage regulator for immunity from voltage distortion caused by non-linear SCR controlled loads on the generator. The PMG shall sustain main field excitation power for optimum motor starting and to sustain short circuit current for selective operation and coordination of system overcurrent devices.

The automatic voltage regulator shall be temperature compensated, solid state design. The voltage regulator shall be equipped with three phase RMS sensing. The regulator shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The regulator shall include an under-frequency roll-off torque matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of 58-59 Hz. The torque matching characteristic shall include differential rate of frequency change compensation to use maximum available engine torque and provide optimal transient load response. Regulators which use a fixed volts per hertz characteristic are not acceptable.

ENGINE-GENERATOR SET CONTROL

The control shall have automatic remote start capability from a panel mounted 3-position (Stop, Run, Remote) switch.

Provide cycle cranking of 15 SEC (ON)/15 SEC (OFF) for three attempts (75 SEC). If the engine fails to start, lockout the engine and indicate overcrank on alarm status panel.

The control shall shut down and lock out upon: failing to start (overcrank), overspeed, low lubricating oil pressure, high engine temperature, or operation of a remote manual stop station. A panel mounted switch shall reset the engine monitor and test all the lamps. Lamp indications on the control panel shall include:

1. Overcrank shutdown – red.
2. Overspeed shutdown- red
3. Low oil pressure shutdown-red
4. High engine temperature shutdown-red
5. High engine temperature prealarm-yellow
6. Low engine oil pressure prealarm-yellow
7. Low coolant temperature-yellow

The NEMA 1 enclosed control panel shall be mounted on the generator set with vibration isolators. A front control panel illumination lamp with ON/OFF switch shall be provided. Control panel mounted indicating meters and devices shall include:

1. Engine oil pressure gauge, Coolant temperature gauge, DC Voltmeter and Running Time Meter (hours).
2. Voltage adjusting rheostat, locking screwdriver type to adjust voltage plus or minus 5% from rated value.
3. Analog AC Voltmeter, dual range, 90 degree scale, 2% accuracy.
4. Analog AC Ammeter, dual range, 90 degree scale, 2% accuracy.
5. Analog Frequency/RPM meter, 45-65 HZ, 1350-1950 rpm, 90 degree scale, plus or minus .6 HZ accuracy.
6. Seven position phase selector switch with OFF position to allow meter display of current and voltage in each generator phase. When supplied with re-connectable generators, the meter panel shall be re-connectable for the voltage specified.

ENGINE

Engine shall be 1800 RPM, stationary, liquid-cooled, spark ignited for fuel as specified below. Engine chosen shall have the lowest emissions available for stated KW rating.

The generator set shall be equipped to operate on natural gas.

Engine components shall include the following:

Engine shall be radiator cooled by engine mounted radiator system including belt-driven pusher fan, coolant pump and thermostat temperature control. The cooling system shall

be rated for full rated load operation in a 40 degree C ambient as measured at the generator air inlet. Radiators shall be provided with a duct adaptor flange. The equipment supplier shall provide 50% ethylene glycol antifreeze solution to fill engine cooling system.

ENGINE ACCESSORIES

The engine generator set shall include the engine accessories as follows:

A 12 volt DC, solenoid shift, electric starter (s) as required by the manufacturer.

Positive displacement, mechanical full pressure lubrication oil pump, full flow lubrication oil filters with replaceable elements, pressure relief valve, dipstick oil level indicator and oil drain valve with hose extension.

Dry element air cleaner with replaceable element. Secondary fuel gas regulator, air/gas valve and throttle body.

Engine starter battery charging alternator, with solid state voltage regulator.

BASE

Each engine generator set shall be mounted on a heavy-duty steel base to maintain alignment between components and shall include vibration isolators provided by the manufacturer.

GENERATOR SET AUXILLIARY EQUIPMENT AND ACCESSORIES:

Generator main circuit breaker, set mounted and wired, UL Listed, molded case thermal-magnetic type. Field circuit breakers shall not be acceptable for generator overcurrent protection.

Engine mounted, thermostatically controlled, water jacket heater (s) for each engine. The heater(s) shall be sized as recommended by the equipment supplier. Heater voltage shall be as required.

Outdoor weather protected housing, factory assembled to generator set base and radiator cowling. Housing shall provide ample airflow for generator set operation. The housing shall have hinged side access doors and rear control door. All doors shall be lockable. All sheetmetal shall be primed for corrosion protection and finish painted with the manufacturers standard color.

Starting and Control Batteries: Starting batteries, lead acid type, 12 volt DC, sized as recommended by the generator set manufacturer, shall be supplied for each generator set with battery cables and connectors.

TRANSFER SWITCH EQUIPMENT:

Complete factory assembled transfer equipment with electronic control designed for surge voltage isolation, voltage sensors on all phases of both sources, linear operator, permanently attached manual handles, positive mechanical and electrical interlocking and mechanically held contacts. Equipment rated at 1000 amps or less shall include quick make, quick break contact mechanisms for manual transfer under load.

All transfer switches and accessories shall be UL Listed and labeled, tested per UL Standard 1008, and CSA Approved.

Ratings: Main contacts shall be rated for 600 Volts AC minimum on transfer switches 40-1000 amps.

Transfer switches shall be rated to carry 100 percent of rated current continuously in the enclosure. Circuit breaker type transfer switches do not meet this specification.

Transfer switches shall be continuously rated in ambient temperatures of -40 to +50 degrees C, relative humidity up to 95% (non-condensing), and at altitudes up to 10,000 feet.

Transfer switch equipment shall have a withstand and closing rating (WCR) in RMS symmetrical amperes greater than the available fault currents shown on the drawings.

CONSTRUCTION: Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in both positions.

Transfer switches shall be equipped with permanently attached manual operating handles and quick break, quick make over-center contact mechanisms suitable for safe manual operation under load.

Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishment. Arc chutes shall have insulating covers to prevent inter-phase flashover.

Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amp, 250 VAC.

Enclosures shall be UL Listed. The enclosure shall provide NEC wire bend space. The cabinet door shall be key locking. Controls on cabinet door shall be key operated. Provide switch position indicator lamps and power available lamps for both sources (four total) on the outside cabinet door.

AUTOMATIC CONTROLS: Control shall be solid state and designed for a high level of immunity to power line surges and transients, demonstrated by test IEEE Standard 587-1980. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all inputs.

Solid state under-voltage sensors shall simultaneously monitor all phases of both sources. Pick-up and drop-out settings shall be adjustable. Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase. Voltage sensors shall have field calibration of actual supply voltage to nominal system voltage.

Automatic controls shall signal the engine generator set to start upon signal from normal source sensors. Solid-state time delay start, adjustable from 0 to 15 seconds (factory set at 2 seconds) shall avoid nuisance start-ups. Battery voltage starting contacts shall be gold, dry type contacts factory wired to a field wiring terminal block.

The switch shall transfer when the emergency source reaches the set point voltage and frequency. Provide a solid-state time delay on transfer, adjustable from 0 to 120 seconds.

The switch shall retransfer the load to normal source after a time delay retransfer, adjustable from 0 to 30 minutes. Retransfer time delay shall be immediately bypassed if the emergency power source fails.

Controls shall signal the engine-generator set to stop after a time delay, adjustable from 0 to 10 minutes, beginning on return to the normal source.

Power for transfer operation shall be from the source to which the load is being transferred.

The control shall include latching diagnostic indicators to pinpoint the last successful step in the sequence of control functions, and to indicate the present status of the control functions in real time, as follows:

Source 1 OK.
Start Gen Set.
Source 2 OK.
Transfer Timing.

Transfer Complete.
Retransfer Timing.
Retransfer Complete.
Timing for Stop.

The control shall include provisions for remote transfer inhibit and area protection. Transfer switches shall be equipped with a field adjustable time delay during switching in both directions, during which time the load is isolated from both power sources, to allow load residual voltage to decay before closure to the opposite source. The delay feature shall have an adjustable range of 0 to 7.5 seconds. Phase angle monitor is not acceptable. Transfer switches supplied without this delay shall have provisions to add it in the field without switch replacement.

Front panel devices shall consist of:

1. A key-operated selector switch to provide the following positions and functions:
 - a. Test - Simulates normal power loss to control for testing of generator set. Controls shall provide for a test with or without load transfer.
 - b. Normal – Normal operating position
 - c. Retransfer – Momentary position to override retransfer time delay and cause immediate return to normal source, if available.

Transfer switches shall be equipped with the following accessories:

- a. Provide a float charge battery charger rated 2 amps.
- b. DC output voltage shall be as required for starting batteries
- c. An ammeter shall display charging current.
- d. The battery charger shall have fused AC input and DC outputs.

Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

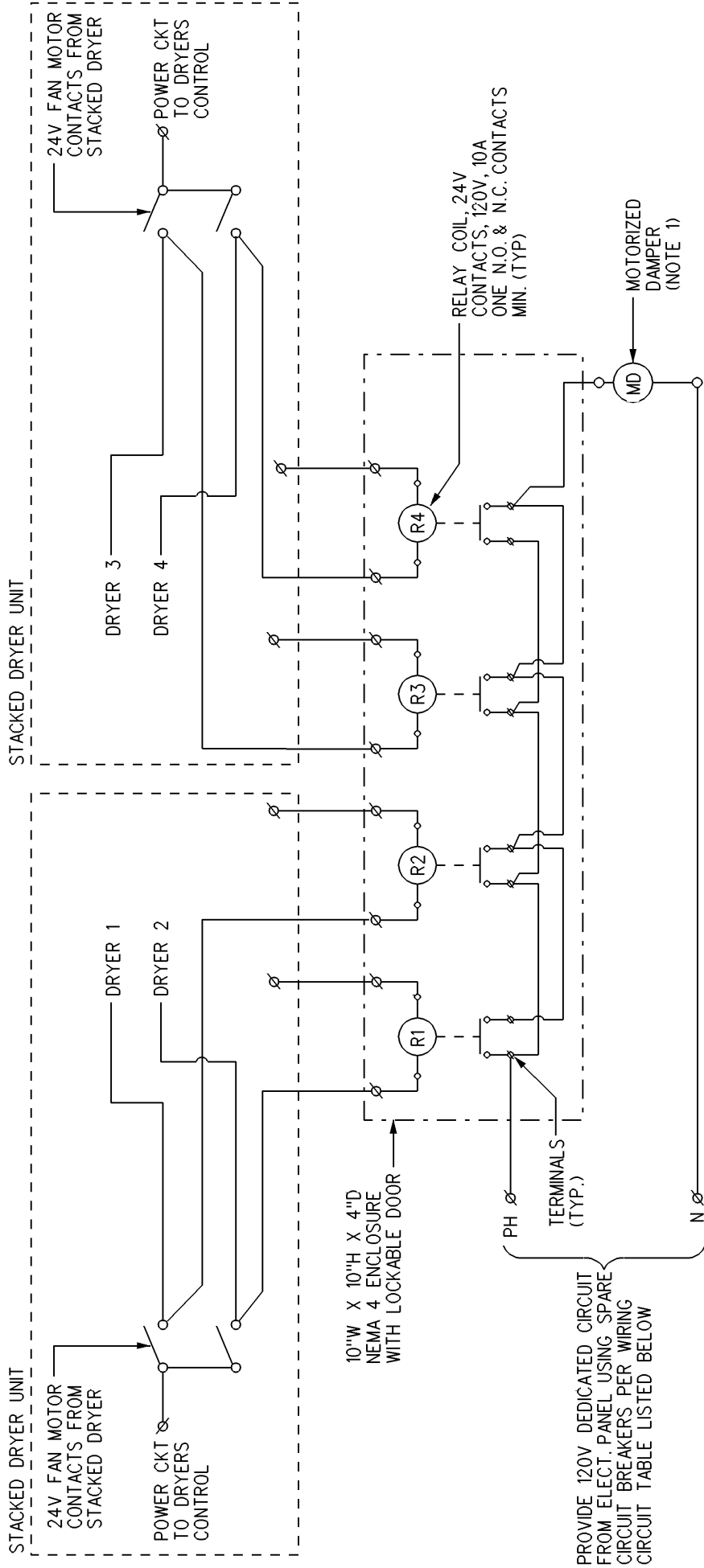
Contract shall include manufacturer servicing, field-testing and calibration of the emergency electrical generating system to demonstrate the equipment is operating within the requirements of the specifications. A portable load bank shall be connected to the generator for field testing at full load for a period of two(2) hours.

Upon completion of all testing and calibration, the Electrical Contractor shall provide the Contracting Officer with a brochure or pocket folder with the following information:

1. All warranties and guarantees on equipment and material provided by the contract.

2. Operating and servicing manuals, instructions and brochures necessary to maintain the equipment in proper working condition.
3. Approved drawings, wiring diagrams and control diagrams on the equipment.
4. Repair parts lists of all major items and equipment including name, address and telephone number of local agent.

JAMES OTT
Director of Public Works



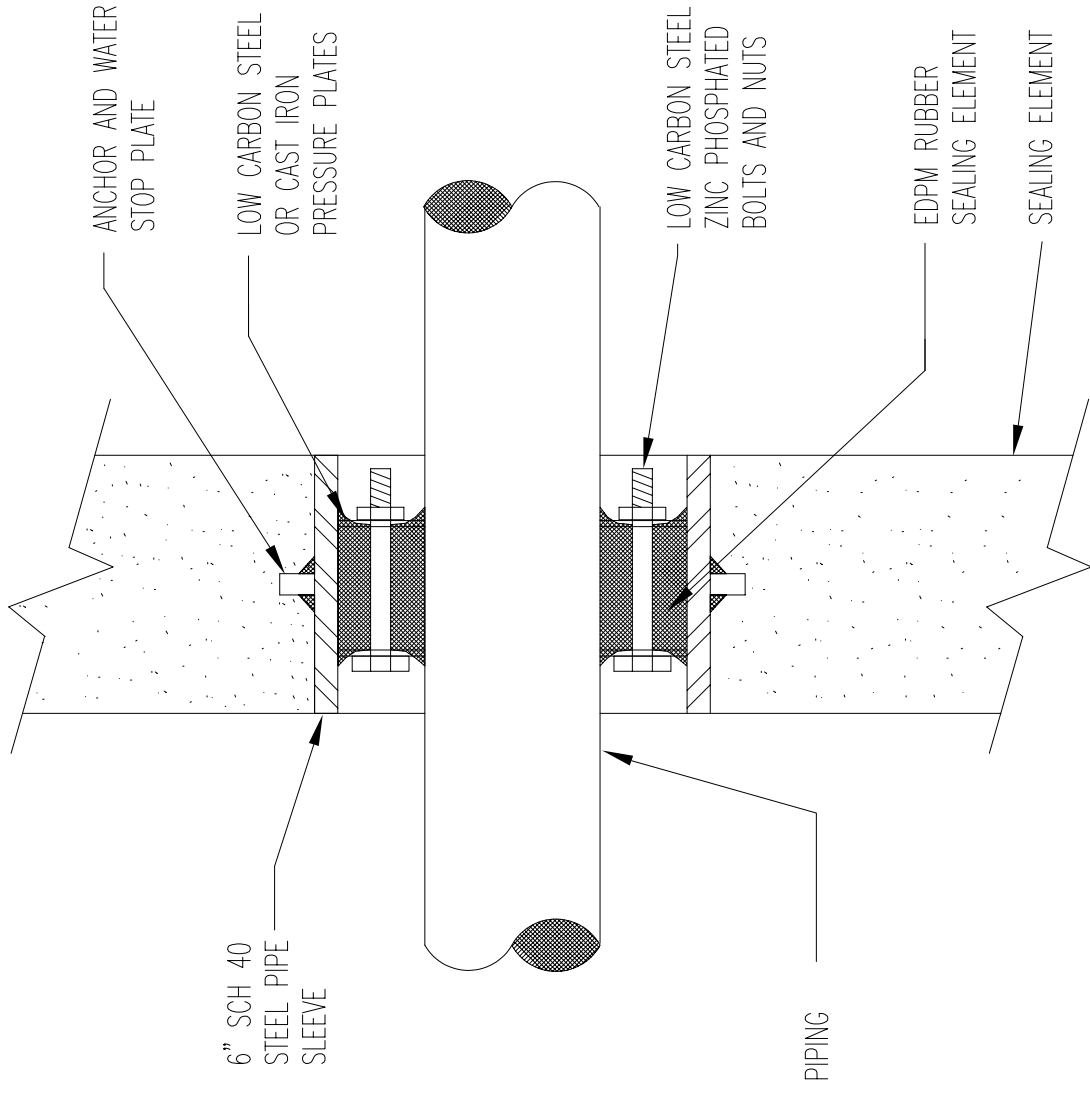
DETAIL - MOTORIZED DAMPER INTERLOCK CONTROL SCHEMATIC

WIRING CIRCUIT TABLE

DWG NO.	LOCATION	CONNECT TO PANEL (NOTES)
E-202	1204E LAUNDRY RM208	PPE-2B (SPARE CIRCUIT BREAKER)
E-203	1204E LAUNDRY RM308	PPE-3B (SPARE)
E-207	1205E LAUNDRY RM119	PPE-1A (SPARE)
E-208	1205E LAUNDRY RM209	PPE-2B (SPARE)
E-209	1205E LAUNDRY RM310	PPE-3B (SPARE)
E-210	1205W LAUNDRY RM121	AP-1W (REUSE EXISTING CIRCUIT FROM PANEL)
E-211	1205W LAUNDRY RM208	PPW-2B (SPARE)
E-212	1205W LAUNDRY RM308	PPW-3B (SPARE)

NOTE

1. MOTORIZED DAMPER ACTUATOR MAY OPERATE IN 24V. ENSURE STEP-DOWN TRANSFORMER ARE PROVIDED FOR ACTUATOR OPERATING VOLTAGE, IF ONE IS NOT SUPPLIED BY ACTUATOR MANUFACTURER.
2. MOTORIZED DAMPER SHALL BE INTERLOCKED WITH THE DRYER OPERATION. DAMPER SHOULD BE IN CLOSE-POSITION WHEN DRYERS ARE OFF, AND IN THE OPEN-POSITION WHEN DRYERS ARE ON (SCHEMATIC SHOWN FOR REFERENCE ONLY.)
3. REFER TO WIRING CIRCUIT TABLE (LEFT) FOR ELECTRICAL FEED TO MOTORIZED DAMPER.



PIPE PENETRATION DETAIL

NOT TO SCALE